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FAMILY PROCESS

ORIGINAL ARTICLE

Family-based physical activity interventions and family functioning: A systematic review

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Abstract

Family physical activity (PA) can confer multiple health benefits, yet whether PA interventions affect general family functioning has not been appraised. The purpose of this review was to evaluate studies that have examined the effect of family PA interventions, where child PA was the focus of the intervention, on constructs of family functioning. Literature searches were concluded on January 11, 2022 using seven common databases. Eligible studies were in English, utilized a family PA intervention, and assessed a measure of family functioning as a study outcome. The initial search yielded 8413 hits, which was reduced to 20 independent PA interventions of mixed quality after screening for eligibility criteria. There was mixed evidence for whether family PA interventions affected overall family functioning; however, analyses of subdomains indicated that family cohesion is improved by PA interventions when children are in the early school years (aged 5–12). High-quality studies also showed an impact of family PA interventions on family organization. Targeted interventions at specific family subsystems (e.g., father–son, mother–daughter), characteristics (low-income, clinical populations, girls), and broad multibehavioral interventions may have the most reliable effects. Overall, the findings show that family PA interventions can promote family cohesion and organization, particularly among families with children in the early school years. Higher quality research, employing randomized trial designs and targeting specific intervention and sample characteristics (e.g., different clinical conditions,

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specific parent–child dyads), is recommended in order to better ascertain the effectiveness of these approaches.

KEYWORDS
adolescents, children, exercise, family cohesion, family organization

INTRODUCTION

Family functioning refers to the social-structural properties of the family environment, which includes conflict, cohesion, organization, and the quality of communication (Alderfer et al., 2008; Kazak et al., 2003). Optimal family functioning occurs within a family environment with clear communication, well-defined roles, and cohesion, while poor family functioning occurs within families with high levels of conflict, and disorganization. These core constructs are central to family-systems models of child development (Bowen, 1966; Bronfenbrenner, 1986; McCubbin et al., 1980; Minuchin, 1974) and considerable evidence has accumulated that links these domains of family functioning to child health and well-being (Drotar, 1997; Halliday et al., 2014; Leeman et al., 2016). Interventions to promote positive family functioning often include family management and therapy (Archambault et al., 2014; Drotar, 1997), yet interventions with a focus on changing family health behaviors, such as dietary behavior, have also shown effectiveness (Nowicka & Flodmark, 2011; Robson et al., 2020).

Interventions to change child and youth physical activity (PA) may also present an opportunity to improve family function. Child and youth PA promotion often includes school-based and community initiatives (van Sluijs et al., 2011; Verjans-Janssen et al., 2018; Wu et al., 2019), yet the family system is likely the centerpiece for enabling and reinforcing lifestyle behavioral patterns (Rhodes, Guerrero, et al., 2020). A child's behavior is interconnected within the structure and function of the family system (Cox & Paley, 1997) and thus support from parents and other family members represent critical enablers of child PA through encouragement, logistical support, modeling, coparticipation, and spectating at child sports (Craggs et al., 2011; Hutchens & Lee, 2018; Pratt et al., 2017; Trost & Loprinzi, 2011). These supports also align with the broader parenting practices literature of responsiveness (providing encouragement and autonomy), structure (providing social/physical environments), and demandingness (restrictive/punitive practices; Davison et al., 2013; Mâsse et al., 2017; Trost et al., 2013). For example, during the COVID-19 pandemic restrictions, parental support of PA was the largest correlate of maintaining, and in some cases, increasing child PA (Moore et al., 2020).

Current observational research highlights the potential link between child and youth PA within the family system and family functioning. For example, a survey of parents on the role of family PA highlighted benefits that included communication, moral lessons, and family fun in conjunction with the well-established physical and mental health benefits of PA (Rhodes & Lim, 2018). Other observational research has shown that higher cohesion and lower entropy are important correlates of children's regular PA (Bates et al., 2019; Trost & Loprinzi, 2011). Parental support for PA is a measure of domain-specific family functioning itself (Trost & Loprinzi, 2011), and the positive association between parental support and child PA has been reviewed extensively (Beets et al., 2010; Edwardson & Gorely, 2010; Hutchens & Lee, 2018; Rhodes, Guerrero, et al., 2020; Rhodes, Perdew, & Malli, 2020; Trost & Loprinzi, 2011; Xu et al., 2015; Yao & Rhodes, 2015). From a theoretical standpoint, behavior change approaches that result in intergenerational parent–child co-PA should allow for positive opportunities to foster family function outcomes such as cohesion, communication, and the affective environment. In addition, promoting parental self-regulation skills aimed to facilitate greater logistical child PA support (e.g., organizing child PA at a local park) may generalize to improve family organization, problem solving, and lowered household chaos.

Despite these positive findings and theoretical rationale, experimental evidence on whether family interventions that focus on child/youth PA impact family functioning outcomes has not been systematically appraised. The effectiveness of family PA interventions that have been designed to impact family function, compared to spill-over effects of more generic family PA interventions where family function is a secondary outcome, has also not been explored. Such a review is needed to assess the state of knowledge in this domain, guide recommendations for future research, assist in practice guidelines for family interventions, and highlight family functioning assessment practices that may be warranted within family PA research focused on children and youth.

Thus, the purpose of this paper was to collect, theme, and appraise studies that have examined the effect of family interventions, where the focus is on promoting child PA, on family functioning outcomes. Specifically, we sought to examine the current evidence for whether (a) family PA interventions affect aspects of general family functioning, and (b) explore whether these effects differ by the characteristics of the family, or the type and design of the PA intervention.

METHOD

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) guidelines (Moher et al., 2009) and preregistered on Prospero (#CRD42021218665).

Eligibility criteria

Studies of interest were defined as any family-based PA intervention that assessed an outcome of family functioning. The included studies must have (1) recruited a family unit, consisting of at least two members, of which there is at least one generation between them (e.g., parent–child dyad) and the child is between the ages of 0 and 17 years; (2) delivered an intervention that included at least some component of PA (e.g., exercise, rough-and-tumble play, sport); and (3) examined and analyzed at least one family functioning outcome, whether this was the primary or a secondary aim of the study, as defined in the review by Alderfer et al. (2008) as: organization, cohesion, communication, affective environment, and problem solving ability. Family functioning outcomes of "General Family Functioning" and "Household Chaos" were added to represent more global measures of family functioning (Emond, 2020), respectively.

The included studies were published articles and dissertations from thesis work, written in English. All types of experimental study designs (e.g., pre-post, randomized controlled trial, within-subject designs) were included.

Information sources, search strategy, and study selection

The search strategies were agreed upon by all the authors and entered into the PubMed, CINAHL, PSYCinfo, SPORTDISCUS, Web of Science, Scopus, and OpenGrey databases for articles up to January 11, 2022, with no initial start date (i.e., all published studies). In addition, a manual cross-referencing of bibliographies was also completed. Complete search strategies can be found in Table S1.

Study selection and quality assessment

Title and abstract screening, as well as full text screening of all retrieved studies were done by WS and HH. A sample of 50 articles were concurrently title and abstract screened by both WS and

HH in order to determine title and abstract screening guidelines. A further 100 articles were then screened by both authors to determine acceptable interscreener reliability. When inconsistencies arose, discussion ensued, and a consensus was achieved. The first author (RR) was consulted if consensus was unable to be achieved.

All three authors conducted the initial data extraction using a 13-item data extraction form, which included author(s) and year of publication, country of study origin and whether the sample was regional or national, total sample size and detailed demographics of the sample, study design/target of the intervention/intervention details, family functioning outcome(s) examined, PA outcome(s) examined (if any), results of the study, and overall risk of bias (see Table S2).

Studies that met the inclusion criteria were assessed for risk of bias with either the Cochrane Risk of Bias Tool 2 (RoB 2; Higgins et al., 2019) or the Cochrane Risk of Bias in Non-randomized Studies of Interventions tool (ROBINS-I Sterne et al., 2019) for randomized controlled trials and nonrandomized studies, respectively. The methodological quality of the studies was independently scored by two authors (WS and HH).

Analysis

Following initial read-throughs of the final, included studies, a priori themes based on the family function outcomes (i.e., general family function, cohesion, communication, organization, problem solving, affective environment, and household chaos), and type of study design (quasi-experimental, randomized controlled trial) were developed. Synthesis of results was narrative (Verbeek et al., 2012), with findings grouped by outcome. Based on Sallis et al.'s (2000) rubric for determining valence and consistency of findings, a theme was considered to: (1) have a positive pathway if >59% of studies reported this effect; (2) a negative effect if >59% of studies reported this relationship; (3) inconclusive if 34%–59% of studies found an association in a given pathway; and (4) no association if <34% of studies showed an association. At least three studies needed to be present to provide an evaluation.

Analyses were presented collectively. A further subanalyses of these results was also conducted by specific design (single group, quasi-experimental, randomized experimental, measurements of PA outcomes), family characteristics (subsystem dyad, gender of child, age of child, socioeconomic status of family, clinical status of child, ethnicity), and intervention characteristics (whether family function was the primary or secondary study aim, change in child moderate-vigorous intensity PA, theoretical base of intervention, PA compared to multibehavior intervention, child vs. multigenerational focus of intervention). Meta-analysis was precluded because there was extensive heterogeneity in the measures, statistical tests employed, number and type of predictors in each equation, definitions of predictors, and study designs, all of which impact the ability to accurately pool the studies for quantitative synthesis (Field, 2015).

RESULTS

Study selection

As shown in Figure 1, the database search yielded 8413 potentially relevant records and 12 articles were identified through other sources. Of those, 1536 duplicate records were removed, and the remaining 6877 records were screened by titles and abstracts. A total of 20 independent samples met inclusion criteria and were included for analysis (Table S2).

Study characteristics

Table 1 describes the characteristics of the 20 samples. The majority of eligible studies were conducted in the United States. (n = 11) and study samples included parent–child dyads (n = 13),

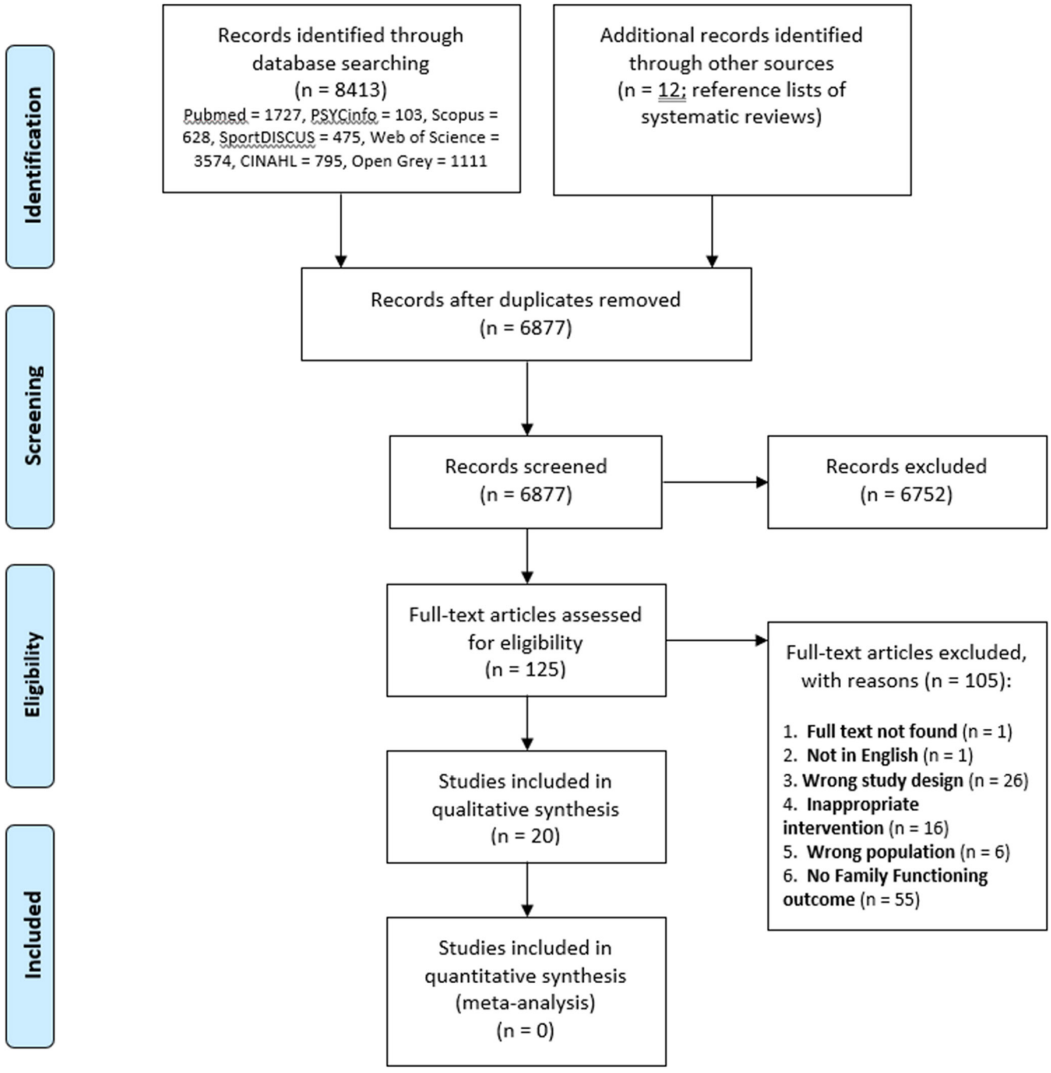

FIGURE 1 PRISMA flow diagram of obtained articles from the literature search to studies included in the review.

or families (n = 6) most often. Half of the studies targeted only children (5–12 years), 15% targeted only early years (0–4 years) and 20% targeted only youth (13–17 years). There were four studies that targeted daughters only, and three studies that targeted sons only. Half of the studies included children with a clinical condition, including obese or overweight (n = 6), attention deficit hyperactivity disorder (n = 2), and autism (n = 2).

Samples were mixed in terms of parent composition, with 20% of studies targeting mothers, 10% targeting fathers, 60% including both mothers and fathers, and 5% targeted other caregivers. The majority of the studies employed randomized controlled trial design (60%) and 25% employed a pre-post design. Studies measured general family functioning (n = 8; 40%), cohesion (n = 14; 70%), organization (n = 4; 20%), communication (n = 8; 40%), affective environment (n = 7; 35%), problem solving ability (n = 2; 10%), and household chaos (n = 1; 5%). Child PA was measured in nine studies (45%) with five applying device-measured PA and five applying self-report PA. The majority of the interventions (n = 17; 85%) included a mode of PA delivery with multimodal being the most common (n = 8), followed by free play (n = 3), exergaming

TABLE 1 Overall study characteristics.

Characteristic	Number of samples	Percentages
Total studies (n = 20) Number of unique samples (n = 20)		
Location		
United States	11	55
United Kingdom	3	15
Australia	2	10
Canada	1	5
New Zealand	1	5
Poland	1	5
South Africa	1	5
Spain	1	5
Study design		
Randomized controlled trial	12	60
Pre-post	5	25
Quasi-experimental	1	5
Cluster randomized trial	1	5
Within-subjects repeated-measures	1	5
Length of intervention		
<6 weeks	4	20
≥6 weeks	16	80
Age of children		
Early years (0–4 years)	3	15
Children (5–12 years)	10	50
Youth (13–17 years)	4	20
All ages	1	5
Gender of children		
Sons	3	15
Daughters	4	20
Either/both	12	60
Parents		
Mothers	4	20
Fathers	2	10
Either/both	12	60
Caregivers	1	5
None	1	5
Ethnicity of the family		
White/Caucasian	2	10
Black	2	10
Hispanic/Latino	2	10
Multiethnic	7	35
Not specified	7	35
Subject(s) of intervention		
Mother–daughter dyads	3	15
Father–son dyads	1	5
Father–daughter dyads	1	5

TABLE 1 (Continued)

Characteristic	Number of samples	Percentages
Either/both dyads	8	40
Families	6	30
Youth only	1	5
Measure of family functioning		
General family functioning	8	40
Cohesion	14	70
Organization	4	20
Communication	8	40
Affective environment	7	35
Problem-solving ability	2	10
Household chaos	1	5
Measure of child PA		
Any type of measure	9	45
Device-measured PA	5	25
Self-reported PA	5	25
Intervention mode of PA delivery		
Undescribed	1	5
Walking	1	5
Sport activities	1	5
Free play	3	15
Exergaming	2	10
Multimodal	8	40
Outdoor recreation	1	5
Theoretical framework		
Cognitive-behavioral	6	30
Humanistic	3	15
Attachment/parenting theory	4	20
Attention restoration theory	1	5
Not specified	6	30
Family function a primary aim of the intervention		
Yes	16	80
No	4	20
Clinical status of child		
Obese or overweight	6	30
ADHD	2	10
Autism	2	10

(n = 2), sport activities (n = 1), and walking (n = 1). Theoretical underpinnings of interventions were cognitive-behavioral (n = 6), humanistic (n = 3), attachment/parenting theory (n = 4), attention restoration theory (n = 1) and not specified (n = 6). The majority of the interventions (n = 16; 80%) had a primary aim of improving family functioning.

Risk of bias analyses for the randomized controlled trials demonstrated that one study was low risk of bias, four studies demonstrated some concerns, and nine studies were deemed to have a high risk of bias. Risk of bias analyses for nonrandomized trials found no studies to have a low risk of bias, three studies with a moderate risk of bias, and four studies with a high risk of bias (see Figure 2; Figures S1 and S2).

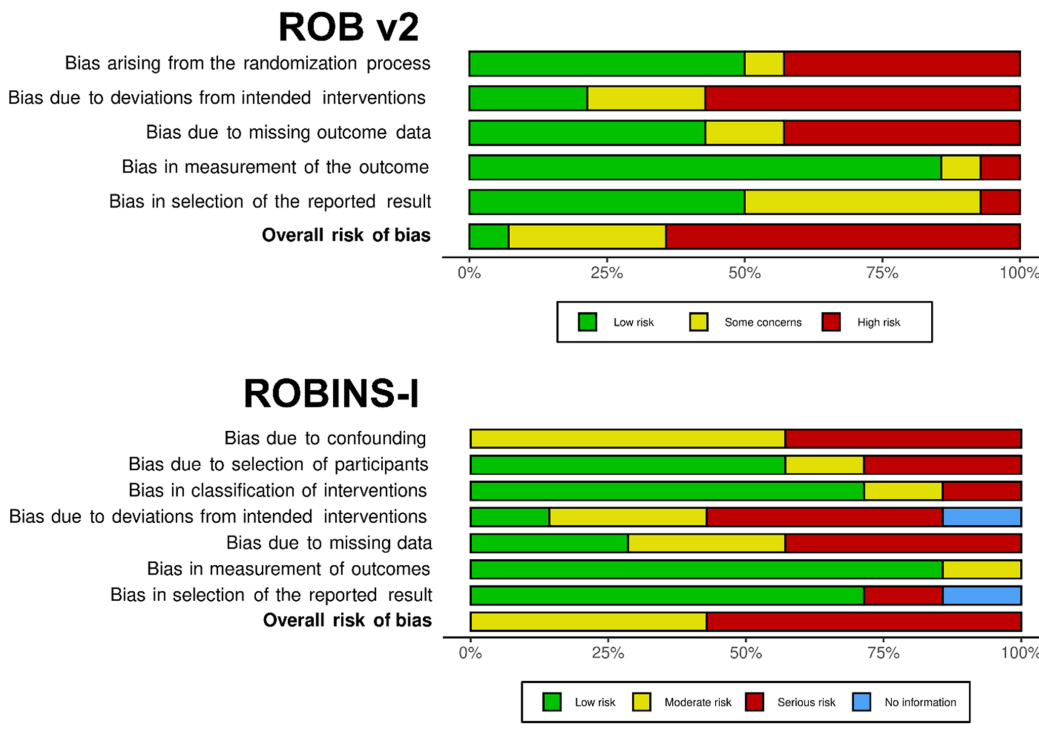

FIGURE 2 Risk of bias of included studies.

Family function outcomes

Summary of overall family function

Table 2 reports the effects of the included studies on outcomes of family functioning. Of the 20 independent samples that reported quantitative outcomes, 11 showed positive effects on at least one measure of family functioning (Berry et al., 2007; Bronikowski et al., 2016; Ellis et al., 2014; Izenstark & Ebata, 2017; Marsh et al., 2020; Prado et al., 2020; Schwinn et al., 2014; Sepúlveda et al., 2020; Verreault et al., 2011; Wagener et al., 2012; Young et al., 2019), two studies reported evidence of decreased family functioning from PA intervention (Fenner et al., 2016; Ransdell et al., 2003), and the other seven studies showed no significant change in any family function variable (Gonzalez, 2014; Guagliano et al., 2020; Hawkins et al., 2018; Hutchings et al., 2016; Robertson et al., 2017; Wenzel et al., 2020; Wright, 2015). The heterogeneity in these mixed results highlights the need to further subcategorize these studies to discern whether there is a pattern to the findings.

General family functioning

Eight intervention studies reported outcomes of general (i.e., an amalgam of multiple family functioning factors) family functioning. Two of these studies reported significant positive changes resulting from the intervention (Ellis et al., 2014; Wagener et al., 2012), one reported significant family function deterioration (Fenner et al., 2016), and five studies showed no differences (Berry et al., 2007; Gonzalez, 2014; Guagliano et al., 2020; Hawkins et al., 2018; Wenzel et al., 2020). Subanalyses showed no apparent difference by age and gender of the child, and focus and content of the intervention, while there was not enough PA outcome information presented

TABLE 2 Quantitative studies focused on the effect of family physical activity on family function.

Correlate	Studies with a positive effect	Studies with a negative effect	Studies with no effect	Overall effect
Family function construct				
Overall summary	Berry et al. (2007); Bronikowski et al. (2016); Ellis et al. (2014); Izenstark and Ebata (2017); Marsh et al. (2020); Schwinn et al. (2014); Sepúlveda et al. (2020); Verreault et al. (2011); Wagener et al. (2012); Young et al. (2019); Prado et al. (2020)	Fenner et al. (2016); Ransdell et al. (2003)	Gonzalez (2014); Hawkins et al. (2018); Hutchings et al. (2016); Robertson et al. (2017); Wright (2015); Guagliano et al. (2020); Wenzel et al. (2020)	?
General family functioning	Ellis et al. (2014); Wagener et al. (2012)	Fenner et al. (2016)	Berry et al. (2007); Gonzalez (2014); Hawkins et al. (2018); Guagliano et al. (2020); Wenzel et al. (2020)	0
Cohesion	Bronikowski et al. (2016); Ellis et al. (2014); Izenstark and Ebata (2017); Schwinn et al. (2014); Sepúlveda et al. (2020); Young et al. (2019)		Berry et al. (2007); Verreault et al. (2011); Ransdell et al. (2003); Hawkins et al. (2018); Hutchings et al. (2016); Robertson et al. (2017); Wright (2015); Wenzel et al. (2020)	?
Communication	Schwinn et al. (2014); Prado et al. (2020)		Berry et al. (2007); Ellis et al. (2014); Sepúlveda et al. (2020); Verreault et al. (2011); Hawkins et al. (2018); Wenzel et al. (2020)	0
Organization	Berry et al. (2007); Sepúlveda et al. (2020)		Hawkins et al. (2018); Wenzel et al. (2020)	?
Affective environment	Prado et al. (2020)	Ransdell et al. (2003)	Berry et al. (2007); Sepúlveda et al. (2020); Hutchings et al. (2016); Robertson et al. (2017); Wright (2015)	0
Problem solving	Izenstark and Ebata (2017)		(Berry et al. (2007))	?
Low household chaos	Marsh et al. (2020)			NA
Child physical activity outcome				
Significant change	Bronikowski et al. (2016); Young et al. (2019)	Ransdell et al. (2003)		+
No change	Berry et al. (2007); Schwinn et al. (2014); Sepúlveda et al. (2020); Prado et al. (2020)		Robertson et al. (2017); Guagliano et al. (2020)	+
Child age				
Early years (aged 0–5)	Marsh et al. (2020)		Hutchings et al. (2016); Wright (2015)	0

(Continues)

TABLE 2 (Continued)

Correlate	Studies with a positive effect	Studies with a negative effect	Studies with no effect	Overall effect
Children (aged 6–12)	Bronikowski et al. (2016); Ellis et al. (2014); Izenstark and Ebata (2017); Schwinn et al. (2014); Sepúlveda et al. (2020); Verreault et al. (2011); Young et al. (2019)		Gonzalez (2014); Robertson et al. (2017); Guagliano et al. (2020)	+
Adolescents (aged 13–17)	Wagener et al. (2012); Prado et al. (2020)	Fenner et al. (2016); Ransdell et al. (2003)		?
All ages			Wenzel et al. (2020)	NA
Child gender				
Girls	Izenstark and Ebata (2017); Schwinn et al. (2014); Young et al. (2019)	Ransdell et al. (2003)		+
Boys	Ellis et al. (2014); Verreault et al. (2011)		Gonzalez (2014)	+
Mixed	Berry et al. (2007); Bronikowski et al. (2016); Marsh et al. (2020); Sepúlveda et al. (2020); Wagener et al. (2012); Prado et al. (2020)	Fenner et al. (2016)	Hutchings et al. (2016); Robertson et al. (2017); Wright (2015); Guagliano et al. (2020); Wenzel et al. (2020)	?
Child clinical status				
Obesity	Berry et al. (2007); Sepúlveda et al. (2020); Wagener et al. (2012); Prado et al. (2020)	Fenner et al. (2016)	Robertson et al. (2017)	+
Autism			Gonzalez (2014); Wenzel et al. (2020)	NA
ADHD	Verreault et al. (2011)	Fenner et al. (2016)		NA
Intervention focus (demographic)				
Ethnicity	Ellis et al. (2014); Prado et al. (2020)	Ransdell et al. (2003)	Gonzalez (2014); Wright (2015)	?
Low SES	Ellis et al. (2014); Schwinn et al. (2014)		Wright (2015)	+
Intervention focus (dyad)				
Mother–Daughter	Izenstark and Ebata (2017); Schwinn et al. (2014)	Ransdell et al. (2003)		+
Father–Son	Ellis et al. (2014)			NA
Father–Daughter	Young et al. (2019)			NA

TABLE 2 (Continued)

Correlate	Studies with a positive effect	Studies with a negative effect	Studies with no effect	Overall effect
Intervention focus (subject of behaviour change)				
Child only	Ellis et al. (2014); Marsh et al. (2020); Sepúlveda et al. (2020); Verreault et al. (2011); Wagener et al. (2012); Young et al. (2019)	Fenner et al. (2016)	Hutchings et al. (2016); Robertson et al. (2017); Wright (2015)	+
Multi-generational	Berry et al. (2007); Bronikowski et al. (2016); Izenstark and Ebata (2017); Schwinn et al. (2014); Prado et al. (2020)	Ransdell et al. (2003)	Gonzalez (2014); Hawkins et al. (2018); Guagliano et al. (2020); Wenzel et al. (2020)	?
Intervention content focus (target behavior)				
Healthy eating and physical activity	Berry et al. (2007); Sepúlveda et al. (2020); Prado et al. (2020)		Robertson et al. (2017)	+
Physical activity only	Bronikowski et al. (2016); Izenstark and Ebata (2017); Wagener et al. (2012); Young et al. (2019)	Ransdell et al. (2003)	Gonzalez (2014); Hawkins et al. (2018); Wright (2015); Guagliano et al. (2020); Wenzel et al. (2020)	?
Multi-health behavior	Ellis et al. (2014); Marsh et al. (2020); Schwinn et al. (2014); Verreault et al. (2011)	Fenner et al. (2016)	Hutchings et al. (2016)	+
Intervention content focus (design)				
Family function the primary aim	Berry et al. (2007); Ellis et al. (2014); Izenstark and Ebata (2017); Marsh et al. (2020); Schwinn et al. (2014); Sepúlveda et al. (2020); Verreault et al. (2011); Young et al. (2019); Prado et al. (2020)	Fenner et al. (2016); Ransdell et al. (2003)	Gonzalez (2014); Hawkins et al. (2018); Hutchings et al. (2016); Robertson et al. (2017); Wenzel et al. (2020)	?
Family function a secondary aim	Bronikowski et al. (2016); Wagener et al. (2012)		Wright (2015); Guagliano et al. (2020)	?
Intervention mode of physical activity delivery				
Undescribed	Ellis et al. (2014)			NA
Walking	Izenstark and Ebata (2017)			NA
Sport activities	Bronikowski et al. (2016)			NA
Free play	Marsh et al. (2020); Verreault et al. (2011)		Wright (2015)	+
Exergaming	Wagener et al. (2012)		Gonzalez (2014)	NA

(Continues)

TABLE 2 (Continued)

Correlate	Studies with a positive effect	Studies with a negative effect	Studies with no effect	Overall effect
Multi-modal	Berry et al. (2007); Young et al. (2019); Prado et al. (2020)	Fenner et al. (2016); Ransdell et al. (2003)	Hawkins et al. (2018); Robertson et al. (2017); Guagliano et al. (2020)	?
Outdoor recreation			Wenzel et al. (2020)	NA
Intervention theoretical frame				
No stated theory	Bronikowski et al. (2016); Schwinn et al. (2014); Wagener et al. (2012)		Gonzalez (2014); Hawkins et al. (2018); Wenzel et al. (2020)	?
Cognitive-behavioral	Berry et al. (2007); Ellis et al. (2014); Sepúlveda et al. (2020); Verreault et al. (2011)	Ransdell et al. (2003)	Hutchings et al. (2016)	+
Humanistic	Young et al. (2019)	Fenner et al. (2016)	Guagliano et al. (2020)	?
Attachment/ parenting theory	Marsh et al. (2020); Prado et al. (2020)		Robertson et al. (2017); Wright (2015)	?
Attention restoration	Izenstark and Ebata (2017)			NA

Note: At least three studies were required for a theme and an estimate of strength behavior. + = positive association (>59% of studies), − = negative association (>59% of studies), ? = indeterminate (34%–59% of studies showing an association) and 0 = no association (<34% of studies showing any association).

within these studies to evaluate whether changes in family function aligned with changes in PA. Of note, however, the two studies that did report significant changes in family function also reported higher quality designs that employed control groups (Ellis et al., 2014; Wagener et al., 2012), while four of the studies that had null or negative findings used single-sample designs (Fenner et al., 2016; Gonzalez, 2014; Hawkins et al., 2018; Wenzel et al., 2020). The results highlight that studies with lower risk of bias may be resulting in more favorable family function outcomes.

Cohesion

Cohesion (i.e., involvement and closeness) was assessed as an outcome of PA interventions in 14 studies and the results were mixed, with six reporting positive outcomes (Bronikowski et al., 2016; Ellis et al., 2014; Izenstark & Ebata, 2017; Schwinn et al., 2014; Sepúlveda et al., 2020; Young et al., 2019) and eight studies showing no effect (Berry et al., 2007; Hawkins et al., 2018; Hutchings et al., 2016; Ransdell et al., 2003; Robertson et al., 2017; Verreault et al., 2011; Wenzel et al., 2020; Wright, 2015). The subanalysis showed no apparent difference by study design, PA outcomes, and focus/content of the intervention. However, there were differences by the gender and age of the child in these interventions. Specifically, three (Izenstark & Ebata, 2017; Schwinn et al., 2014; Young et al., 2019) of the four (Ransdell et al., 2003) studies to include samples of girls had positive effects on family cohesion as a result of the intervention, compared to five null trials with mixed samples (Berry et al., 2007; Hawkins et al., 2018; Hutchings et al., 2016; Robertson et al., 2017; Wenzel et al., 2020; Wright, 2015) and an even mix of positive (Ellis et al., 2014) and null (Verreault et al., 2011) results for samples of boys. Also, all six studies to show positive effects of the intervention on family cohesion involved children aged 5–12 (Bronikowski et al., 2016; Ellis et al., 2014; Izenstark & Ebata, 2017; Schwinn et al., 2014; Sepúlveda et al., 2020; Young et al., 2019), while the studies with null findings comprised more studies with children in the early years (Hutchings et al., 2016; Wright, 2015), youth aged 13–17 (Ransdell et al., 2003), and mixed samples of children and youth (Berry et al., 2007; Hawkins et al., 2018; Wenzel et al., 2020).

Communication

Eight intervention studies included communication (e.g., clarity of expression and directness) outcomes, yet only two studies (Prado et al., 2020; Schwinn et al., 2014), found improvements in parent–child communication. The other six studies reported null outcomes (Berry et al., 2007; Ellis et al., 2014; Hawkins et al., 2018; Sepúlveda et al., 2020; Verreault et al., 2011; Wenzel et al., 2020). One of the studies that included communication outcomes had both quantitative and qualitative assessments (Hawkins et al., 2018). These results were divergent with a positive qualitative theme but a nonsignificant quantitative outcome, yet the study is also marked by a short (weekend) intervention.

Organization

Only four studies assessed whether a family PA intervention affected the organization of the family (e.g., roles, leadership); however, two studies found significant improvements as a result of the intervention (Berry et al., 2007; Sepúlveda et al., 2020) and two studies reported null results (Hawkins et al., 2018; Wenzel et al., 2020). Risk of bias between these studies may be contributing to these mixed findings, because the two studies with null findings were both single-group designs

with a short (weekend) intervention. Of the positive outcomes, Berry et al. (2007) employed a randomized controlled trial involving a 6-week intervention condition to improve family nutrition and exercise outcomes with cognitive-behavioral techniques among children aged 7–17 and showed improvements in perceptions of parental control of family behaviors and activities. Sepúlveda et al. (2020) also employed a randomized trial design to explore a similarly focused intervention among obese children (aged 8–12) specifically or as an entire family. The researchers found that the family focused intervention arm showed improvements in parental perceptions of roles and leadership adaptation over time in comparison to the same intervention that was focused only at the child-level.

Affective environment

There was a clear indication that family PA interventions do not impact the overall family affective environment (e.g., expression of feelings, conflict) with six trials that measured affective environment reporting either null (Berry et al., 2007; Hutchings et al., 2016; Robertson et al., 2017; Sepúlveda et al., 2020; Wright, 2015) or negative consequences (Ransdell et al., 2003) and only one study with a positive outcome (Prado et al., 2020).

Family problem solving ability

Only two family interventions included a measure of family problem solving (e.g., goal negotiation, task accomplishment). These studies had mixed outcomes with one increase as a result of a single-bout mother–daughter nature-based walking condition (Izenstark & Ebata, 2017) contrasted by one null result from a 6-week family obesity prevention program focused on children of all ages (Berry et al., 2007).

Household chaos

Household chaos (e.g., busyness of the family and order of the family home environment) was only assessed in one study, featuring mothers and their early year's children (Marsh et al., 2020). Compared with the control group, the intervention group demonstrated significant improvements from baseline in chaos scores at 12 weeks postintervention.

Subanalyses of family function outcomes by study and intervention characteristics

Table 2 highlights the subanalyses of family function outcomes by study, family, and intervention characteristics.

Study sample characteristics

Seven (Bronikowski et al., 2016; Ellis et al., 2014; Izenstark & Ebata, 2017; Schwinn et al., 2014; Sepúlveda et al., 2020; Verreault et al., 2011; Young et al., 2019) of the 10 studies (Gonzalez, 2014; Guagliano et al., 2020; Robertson et al., 2017) that focused on increasing PA among children aged 5–12 showed at least one significant positive family function outcome as a result of the intervention. This was contrasted by only one positive finding (Marsh et al., 2020) and two null findings (Hutchings et al., 2016; Wright, 2015) in studies focused on children in the early years (i.e., 0–4), and two positive findings (Prado et al., 2020; Wagener et al., 2012) compared to two

negative results (Fenner et al., 2016; Ransdell et al., 2003) for family function outcomes with youth (13–17).

Three (Izenstark & Ebata, 2017; Schwinn et al., 2014; Young et al., 2019) of the four (Ransdell et al., 2003) interventions focused on girls, and two (Ellis et al., 2014; Verreault et al., 2011) of the three (Gonzalez, 2014) studies focused on boys showed at least one positive family function outcome following the intervention. Family PA interventions with mixed gender samples had more mixed evidence of effectiveness, with six studies showing positive effects (Berry et al., 2007; Bronikowski et al., 2016; Marsh et al., 2020; Prado et al., 2020; Sepúlveda et al., 2020; Wagener et al., 2012) and six studies showing null (Guagliano et al., 2020; Hutchings et al., 2016; Robertson et al., 2017; Wenzel et al., 2020; Wright, 2015) or negative (Fenner et al., 2016) effects.

Four (Berry et al., 2007; Prado et al., 2020; Sepúlveda et al., 2020; Wagener et al., 2012) of the six (Fenner et al., 2016; Robertson et al., 2017) studies with obese children as the focus of the intervention showed positive changes in at least one family function variable as a result of intervention participation, yet there were too few studies to render a judgment on any other clinical designations.

Intervention characteristics

Three studies reported on the effect of family interventions focused on mothers and their daughters, showing two studies (Izenstark & Ebata, 2017; Schwinn et al., 2014) with positive family function outcomes and one study (Ransdell et al., 2003) with a negative outcome. There were too few studies to render an analysis of studies with father–son or father–daughter focused interventions.

Three family-based interventions focused on families of lower socioeconomic status explored their effect on family function. Two of these studies (Ellis et al., 2014; Schwinn et al., 2014) found positive outcomes on at least one family function variable, while one study (Wright, 2015) showed null results. In contrast, there was mixed evidence in terms of whether tailoring the study for ethnicity was effective with two positive study outcomes (Ellis et al., 2014; Prado et al., 2020), two null study outcomes (Gonzalez, 2014; Wright, 2015) and one negative outcome (Ransdell et al., 2003).

Ten studies had a primary behavior change focus on the child. Among these studies, six (Ellis et al., 2014; Marsh et al., 2020; Sepúlveda et al., 2020; Verreault et al., 2011; Wagener et al., 2012; Young et al., 2019) reported at least one positive family functioning outcome following the intervention, while one study (Fenner et al., 2016) reported negative family function effects and three studies (Hutchings et al., 2016; Robertson et al., 2017; Wright, 2015) reported null outcomes. The other 10 studies were comprised of a more intergenerational focus of PA promotion, of which five (Berry et al., 2007; Bronikowski et al., 2016; Izenstark & Ebata, 2017; Prado et al., 2020; Schwinn et al., 2014) reported at least one positive family functioning outcome following the intervention while one study reported negative family function effects (Ransdell et al., 2003) and four studies reported null outcomes (Gonzalez, 2014; Guagliano et al., 2020; Hawkins et al., 2018; Wenzel et al., 2020).

Four studies (Bronikowski et al., 2016; Izenstark & Ebata, 2017; Wagener et al., 2012; Young et al., 2019) that focused specifically on increasing PA as the focal aspect of the intervention had at least one positive family function outcome following the intervention, compared to five studies (Gonzalez, 2014; Guagliano et al., 2020; Hawkins et al., 2018; Wenzel et al., 2020; Wright, 2015) that showed a null outcome and one study that had a negative effect (Ransdell et al., 2003). In contrast, family interventions that covered several behavioral outcomes with a PA component, often inclusive of parenting behaviors, had four studies (Ellis et al., 2014; Marsh et al., 2020; Schwinn et al., 2014; Verreault et al., 2011) with positive outcomes, one study with a null outcome (Hutchings et al., 2016) and one study with a negative outcome (Fenner et al., 2016). Of the four family intervention studies that focused on energy balance behaviors of

healthy eating and PA, three studies (Berry et al., 2007; Prado et al., 2020; Sepúlveda et al., 2020) reported positive outcomes and one (Robertson et al., 2017) reported a null effect. There was no specific mode of physical activity within the intervention that differentiated an impact on family function outcomes (See Table 2).

Six studies employed variants of a cognitive-behavioral approach to the intervention and showed four studies (Berry et al., 2007; Ellis et al., 2014; Sepúlveda et al., 2020; Verreault et al., 2011) with at least one positive family function outcome following the intervention, compared to one null (Hutchings et al., 2016) and one negative (Ransdell et al., 2003) outcome. Three studies used a humanistic (i.e., self-determination theory) theoretical frame with mixed positive (Young et al., 2019), negative (Fenner et al., 2016), and null (Guagliano et al., 2020) outcomes. An attachment theory approach yielded two positive family function outcomes (Marsh et al., 2020; Prado et al., 2020) and two negative outcomes (Robertson et al., 2017; Wright, 2015). Finally, analyses of studies with no stated theory showed three studies (Bronikowski et al., 2016; Schwinn et al., 2014; Wagener et al., 2012) with positive family function outcomes and three null outcomes (Gonzalez, 2014; Hawkins et al., 2018; Wenzel et al., 2020).

Nine (Berry et al., 2007; Ellis et al., 2014; Izenstark & Ebata, 2017; Marsh et al., 2020; Prado et al., 2020; Schwinn et al., 2014; Sepúlveda et al., 2020; Verreault et al., 2011; Young et al., 2019) of the 16 studies where improving family function was the primary aim of the intervention had positive changes on at least one family function variable. Still, two studies where improving family function was the primary aim of the intervention had negative effects on family function (Fenner et al., 2016; Ransdell et al., 2003) and five studies had null effects (Gonzalez, 2014; Hawkins et al., 2018; Hutchings et al., 2016; Robertson et al., 2017; Wenzel et al., 2020). In comparison, the four studies where family function was a secondary aim of the study showed that two studies had positive effects on family function (Bronikowski et al., 2016; Wagener et al., 2012) and two studies had no effect (Guagliano et al., 2020; Wright, 2015).

Physical activity outcomes

Nine studies reported physical activity outcomes resulting from the intervention and results were mixed in terms of whether these findings were linked to subsequent changes in family function. Two (Bronikowski et al., 2016; Young et al., 2019) of three studies showing significant changes in child physical activity as a result of the intervention were also linked to a change in at least one family function outcome. The third study that showed increases in physical activity showed a decline in family function following the intervention (Ransdell et al., 2003). Furthermore, of the six family PA intervention studies that showed no significant changes in child PA postintervention, four of these studies (Berry et al., 2007; Prado et al., 2020; Schwinn et al., 2014; Sepúlveda et al., 2020) showed significant positive changes in at least one family function outcome while two studies (Guagliano et al., 2020; Robertson et al., 2017) showed no changes to family function.

DISCUSSION

Positive family functioning is critical to child development and lifelong social and emotional health within the family system (Barnhill, 1979; Kazak et al., 2003) so understanding whether programs aimed at modifying family health behaviors, such as PA, affect general family function outcomes is paramount. This was the first review to appraise studies that have examined the effect of family PA interventions, where the focus was child/youth PA, on general indicators of family function. To this end, our systematic review identified 20 independent family PA interventions that employed at least one quantitative outcome of family functioning. For instance, the included work examined a wide variety of family functioning outcomes (e.g., cohesion, communication), family structures (e.g., mothers, fathers, dyads, families), and demographics

of parents/children (e.g., age of child(ren), ethnicity) through multiple theoretical lenses (e.g., socio-cognitive theory, no theory) and study designs (e.g., single-arm, quasi-experimental, RCT), with 80% of these studies focused on changing family function as its primary aim. Despite the diversity of the findings, the results presented in this review offer a rich source of preliminary evidence and recommendations for future research, with respect to family-based PA interventions and family functioning.

Overall, results for whether family PA interventions impact family function were mixed. Eleven of the 20 studies showed positive effects of the PA intervention on family functioning domains. It is noteworthy, however, that only two interventions showed decreases in family function, so PA interventions appear to do little harm to the functioning of the family in most cases. However, the mixed results demonstrate that a more fine-grained analysis of specific family functioning domains was warranted, which is discussed below.

The most researched family functioning domain has been cohesion, which makes sense because PAs are likely performed together between parents and their children in direct (co-participation) or indirect (parental logistical support) capacities (Yao & Rhodes, 2015). Our results suggested mixed effects of PA interventions on cohesion, yet there was clear differentiation in the results by study quality. Specifically, higher quality trials showed a more consistent positive effect of family PA interventions on family cohesion. Further subanalyses by child age also accounted for these mixed findings, although the smaller samples in many of the subanalyses mean that conclusions from these results should be considered with caution until replicated with more research. Family PA interventions among children aged 5–12 had more success in positively affecting family function variables, compared to young children or adolescents. The effect was particularly prominent on cohesion. This likely represents the optimal stage of child development for where interventions like family PA can affect cohesion, because children in the early years may be too young to be overtly responsive in the family system, while youth are increasingly seeking and reliant on social and emotional development with members external to the family, such as peers (Ragelienė, 2016), particularly when related to PA (Fitzgerald et al., 2012). This theorizing has also been supported by survey results, where parents reported increasing barriers to coparticipation in PA with their children as they moved to adolescence due to differential preferences in the types of physical activities enacted (Rhodes & Lim, 2018). It also mimics a general decrease in parental support for PA between childhood and youth (Rhodes et al., 2019). Taken together, the results highlight that cohesion may be improved most in family PA interventions during the childhood and preadolescent years. Practitioners aiming to improve cohesion through PA promotion may need to consider the developmental status of children to maximize effectiveness.

Interestingly, family organization also showed evidence as another family function variable that might improve from PA intervention, particularly when subanalyses were separated to the higher quality trials. There was also some indication that family PA interventions may have positive effects on problem solving and reducing household chaos. The results are preliminary at present, with a limited number of studies, so future research is still warranted to establish these findings. However, from a theoretical standpoint, it may be that the structure imposed by increasing regular PA within the family system helps establish parental support roles, group problem solving, and lowering chaos by increasing the efficacy and value of parenting (Trost & Loprinzi, 2011). Increased parenting efficacy has also been linked to better family functioning (Bandura et al., 2011; Lamb et al., 2016), supporting this likely theoretical relationship between family PA interventions and these key family functioning outcomes. While it is too premature to provide practice recommendations, the early results support sustained research in these domains.

While the results of our review showed some domains of family functioning that may be improved by PA interventions, there were also certain domains that seem unaffected. Our conclusion from the reviewed studies is that family PA interventions are not effective for changing the affective environment and communication. These are broad family functioning domains with complex antecedents of child and parent personal characteristics and external social/environ-

mental determinants (Churchill et al., 2018; Gonzalez-Calvo et al., 1997). Selected approaches to making positive changes in these domains have involved case management (Churchill et al., 2018; Gonzalez-Calvo et al., 1997), family-based problem solving (Narad et al., 2015), and positive psychology (Ho et al., 2016; Morganson et al., 2014). It may be that health behavior interventions such as improving PA are not equipped with the necessary behavior change techniques and resulting outcomes to affect such complex family function domains (Archambault et al., 2014; Drotar, 1997).

An additional aim of this review was to explore whether results differed by the characteristics of the family or the intervention. While these analyses contained only a handful of studies and thus warrant replication, there were some early indications that targeted interventions (e.g., clinical status, specific parent–child dyad, girls only, low SES) may be slightly more effective than generic family interventions. This could represent the perception of exclusivity that involves a targeted health intervention (Schmid et al., 2008) or some of the specific content within these interventions. Similar outcomes were derived from our subanalyses of intervention content on family function. Most interesting was that the family function outcomes appeared to be independent of whether child PA increased significantly. This may in part underscore that the *process* of family PA intervention (e.g., family system working together for change) is more important than the *outcome*. There was some evidence to suggest that multibehavior interventions that involved more than just PA promotion aims had more reliable effects on positive family function outcomes. This makes sense from a theoretical standpoint. Multibehavior interventions would seek to improve many domains of family life (e.g., eating behaviors, communication, sedentary behavior, general parenting) and thus do appear more likely to affect the broader domains of family functioning that encompass these other aspects in the family system. There were also indications that interventions that focused more on the health behaviors of the child, and not on the entire family, had slightly better family function outcomes. Continued research with multiarm comparison groups are needed to better understand the magnitude of these differences. Finally, there was little conclusive evidence for whether the theoretical approach guiding the intervention, and whether changing family function was the primary aim of the study, had any impact on family functioning results. This is a common finding in PA interventions, often because so many of the underlying behavior change techniques are similar across all approaches and most behavioral domains (McEwan et al., 2019).

Limitations and future directions

Despite the innovative findings contained within this review, there were also some limitations. The review is limited by the search terms and search engines employed as well as studies in English and French (translated to English). Future research may benefit from expanding upon the experimental design focus of this review (e.g., observational, qualitative designs) and a potentially broader conception of family function (e.g., child–parent relations, coordinated health behavior participation, impact on the well-being of parental dyads). Furthermore, despite our inclusion of gray literature, our analysis methods were also biased toward flagging any effect within a category of family functioning that was found statistically significant and our subanalyses often included small samples. We believe this is an appropriate first assessment for this topic but a more refined analysis in the future that focuses on effect size with a larger number of studies may yield different findings. Estimations of the magnitude of these effects requires future meta-analytic analyses as this area of literature matures. We recommend that authors provide the necessary information for meta-analysis (e.g., means, standard deviations, subsample sizes) in order to make this transparent for future reviews and updates. Sustained research that includes generic compared to specific targeted family interventions (e.g., different clinical conditions, specific parent–child dyads) is also recommended in order to better ascertain the effectiveness of these approaches. Notably, the majority of the studies examined in this review also presented either some concerns for bias or

serious risk of bias. Among studies utilizing an RCT design, prevailing sources of bias generally stemmed from the randomization process, deviations from intended intervention, and missing outcome data. Based on these concerns, future studies should seek to employ randomized designs with concealed allocation, when possible, and to use appropriate analyses for assessing the effect of assignment (e.g., intention to treat analysis). Furthermore, given the potential sensitivity of family functioning outcomes to a number of external events, future studies should employ appropriate analysis of missing data (e.g., sensitivity analyses) and control for potential confounding variables (e.g., age of child, age of parents) when employing nonrandomized designs. Finally, our study findings represent a mix of family function outcomes, where the family PA intervention was designed specifically to promote family function and where family function was examined as a possible unanticipated secondary outcome of the intervention. Future research where family PA interventions are specifically designed to increase family function outcomes (e.g., a PA intervention focused on planning and monitoring designed to assist in family organization) is recommended to increase the effectiveness of testing theory-based approaches.

CONCLUSIONS

In summary, family PA can confer multiple health benefits to parents and their children, yet the role of how family PA interventions affect family functioning was not well-understood. Positive family functioning is critical to child development and lifelong social and emotional health within the family system (Barnhill, 1979; Kazak et al., 2003) so understanding whether programs aimed at modifying family health behaviors such as PA spill-over to affect general family function outcomes is paramount. This review showed mixed evidence for whether family PA interventions affected family functioning; however, analyses of the subdomains of family functioning indicated that cohesion, organization, problem solving, and reduced chaos may be improved by PA interventions, particularly when children are in the primary and intermediary school years (e.g., aged 5–12). There appeared to be no effect of PA interventions on the affective environment and communication domains of family function. Subanalyses of a small number of studies showed specific characteristics of family demographics and intervention components did not have clear evidence of moderation of the effects of these PA interventions on family function. Still, there was some indication that targeted interventions (e.g., father–son, mother–daughter) at specific family subsystems and characteristics (low-income, clinical populations) and broad multibehavioral (eating, parenting, PA, etc.) over specific PA-only interventions may have the most reliable effects on improving family functioning.

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DATA AVAILABILITY STATEMENT
All data used has been presented in our appendices.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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